

WHAT THEY CALL A PORTABLE, WE CALL A LOAD.



Sharp Electronics Corp., 10 Sharp Plaza, Paramus, NJ 07652

Today, almost everyone claims to have a portable computer. The problem is, almost no one does. Most portables have a separate data storage device, separate printer, separate modem, and some even require a separate monitor or bulky battery pack that can make them a liability on the road.

The Sharp PC-5000, on the other hand, is a true portable. It's a compact 16 bit, 128K microprocessor (expandable to 320K) with 192K of ROM, an 80 character display screen, removable bubble memory storage, built-in rechargeable power source and bundled software. It's also available with options like an integrated modem that lets you connect with your mainframe and an integrated correspondence-quality printer which doesn't increase the size of the system. And even with all these features, the PC-5000 fits neatly into a briefcase and weighs under 14 pounds. Almost 25% less than its nearest major competitor. At a price that's lighter, too.

Of course, there's one thing about the PC-5000 that isn't small. Its working capacity. It functions as a desktop computer. And is compatible with a wide variety of MS-DOS® software.

So if you need a truly portable computer, look into the Sharp PC-5000. The one that may be the smallest, lightest—and the best value for the money. In short, a computer that will lighten your work load. Not add to it.

For more information call
1-800-BE-SHARP or fill in the coupon.

MS-DOS® is a registered trademark of Microsoft Corporation.

A/V EQUIPMENT, AUDIO, BANKING SYSTEMS, CALCULATORS, CASH REGISTERS, COMPUTERS, COPIERS, ELECTRONIC TYPEWRITERS, FACSIMILE EQUIPMENT, MICROWAVE OVENS, PROFESSIONAL VIDEO CAMERAS & MONITORS, TELEVISIONS, VIDEO TAPE RECORDERS.



FROM SHARP MINDS
COME SHARP PRODUCTS

Sharp Electronic Corp.
Computer Systems Division
1909 E. Cornell, Peoria, IL 61614

- Please send me more information
about Sharp's PC-5000.
 Please set up a demonstration.

Name _____

Title _____

Company _____

Street _____

City _____ State _____ Zip _____

Phone () _____

SHARP®

NEW PC-5000 PACKAGES

PC-5000 WITH 37 CPS PRINTER

\$1995

- 16 BIT, MS-DOS**
- BUNDLED WITH WORD PROCESSING,
COMMUNICATIONS, AND OPERATING
SOFTWARE**
- RECHARGEABLE BATTERY**
- WEIGHS 13 LBS.**

PC-5000 WITHOUT PRINTER

\$1695



SHARP

CE-513F

Micro Floppy Disk Drive

3-1/2" Micro Floppy Disk Drive Enhances PC-5000 Portability

Sharp introduces a battery-powered* 3-1/2" micro floppy disk drive as the newest addition to the portable PC-5000 system. The CE-513F micro floppy disk drive will enhance in-the-field operation of the PC-5000 portable computer. The innovative CE-513F supports the PC-5000 to provide real desktop computer performance anytime and anywhere.

*Rechargeable lead battery option.



CE-513F

Micro Floppy Disk Drive

FEATURES

- The compact, lightweight CE-513F is a 3-1/2" micro floppy disk drive that operates on AC or battery power. It becomes a portable data storage unit to enhance operation of the portable PC-5000 both on the desktop or in the field.
- Interfacing is done directly at the same port as the CE-510F 5-1/4" mini floppy disk drive. Two CE-513F micro drives, or one CE-513F and a CE-510F mini drive are connectable to the PC-5000. Downloading from a CE-510F to a CE-513F provides more flexible and portable data storage.
- Micro floppy battery drain has been minimized when the microdisk isn't accessed.
- Double-sided and double-density, the microdisk provides 360KB of data on 80 tracks (9 sectors/track). The CE-513F utilizes the same format as the IBM*-XT system.
- The CE-513F micro floppy unit rotates disks at a standard 300 rpm. The CE-513F accommodates Sharp CE-120F or other 4440 type 3-1/2" disks which should be formatted for the PC-5000.
- The compact 3-1/2" microdisk is encased in a plastic envelope and is impervious to dust and dirt. This makes it perfect for portable computing applications.

SPECIFICATIONS

Drive:	Single-drive system
Media:	3-1/2" floppy disk
Recording system:	Double side, double density
Tracks:	80 tracks (40 tracks × 2)
Sector:	Soft sector
Capacity (formatted):	360KB/sheet (9 sectors/track)
Power:	Rechargeable lead battery EA-50B(DC 6V) (option); AC adaptor (EA-56) (option)
Operating temperatures:	10°C—35°C (50°F—95°F)
Humidity:	20%—80%
Dimensions:	141mm(W)×230mm(D)×64mm(H) 5-9/16"(W)×9-1/16"(D)×2-17/32"(H)
Weight:	Approx. 2.6kg (5.7 lbs.)

*IBM is a registered trademark of International Business Machines.

Design and specifications subject to change without notice.

SHARP

SHARP ELECTRONICS CORPORATION

10 Sharp Plaza, Paramus, New Jersey 07652
Tel: (201) 265-5600

SHARP CORPORATION OSAKA, JAPAN

CABLE ADDRESS: LABOMET OSAKA
TELEX No.: LABOMET A-B J63428

Distributed by:

SHARP

PORTABLE COMPUTER PC-5000

Sharp Introduces the Portable Office.



PORTABILITY AND PERFORMANCE COME TOGETHER IN
A REVOLUTIONARY NEW 16-BIT PERSONAL COMPUTER

At the Office—At Home—In—

Consider the possibilities of a powerful desk-top computer that can work wherever and whenever you want to work.

Sharp's portable computer, the PC-5000, makes these possibilities a reality.

Sharp's microassembly technology incorporates all the components necessary for high-performance computing in one integrated, portable, lightweight unit. A rechargeable battery adds the final touch to this computer's remarkable mobility.

With the PC-5000 your travel time doesn't have to be downtime.

The PC-5000 is not just designed for the executive or professional, but for anyone who requires greater speed, efficiency, and portability in their ever-increasing information-gathering and management tasks. It is powered by the popular 8088, 16-bit microprocessor that takes advantage of the wide array of MS-DOS* software, readily available in today's marketplace.

Virtually, everything you need in a personal business computer can be carried easily in your briefcase.

* MS-DOS is a trademark of Microsoft Corporation.

Note: To use the PC-5000 activate MS-DOS by using a bubble memory cartridge (CE-100B) or a mini-floppy disk unit (CE-510F) with a system disk (CE-101F).

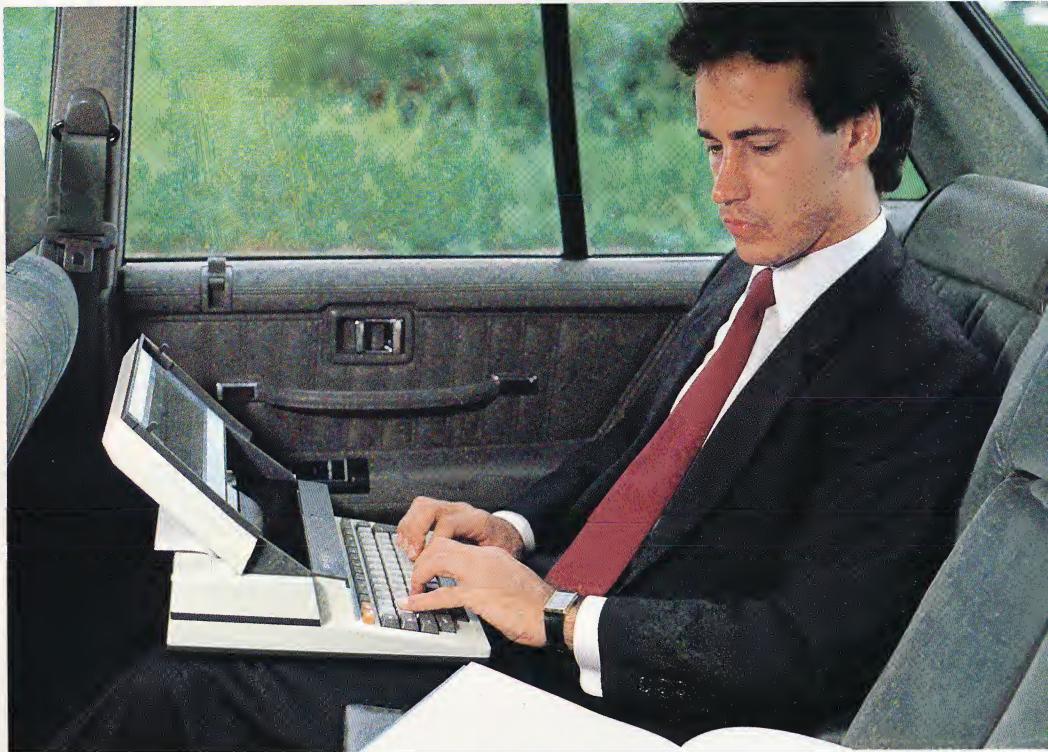


Carry the PC-5000 in your briefcase; it is your portable office.



-between—Anywhere. Anytime.

In a car, on a train, anywhere, the PC-5000 is a mobile workstation that keeps you up to date.



Complex business transactions can be completed quickly and easily with the help of the PC-5000—anyplace, anytime.

You can prepare proposals or enter orders directly into your company's mainframe computer from a client's office where facilities allow.



Portability & Performance

A Compact, Ready-to-run Comp



Printer (CE-510P)
optional

Computer System.

The PC-5000 is a 16-bit portable computer that is all inclusive. Integrated in one small unit is a complete, ready-to-run CPU, display, and keyboard. Give the PC-5000 a heavy workload, and with a memory capacity of 128K bytes, expandable to 256K bytes, it can execute a variety of tasks.

The PC-5000 can be activated anywhere. An optional 37-character-per-second printer quietly types correspondence-quality copy. An acoustic coupler, via the RS-232C interface, can put you in touch with mainframe computers, data bases, and other computers.

Computer

- 16-bit, 8088 microprocessor
- 192K bytes of ROM (128K bytes of file ROM, 64K bytes of ROM)
- 128K bytes of RAM (optionally expandable up to 256K bytes)
- 128K bytes of removable bubble cartridge optionally available
- 8-line by 80-column liquid crystal display (LCD)
- Alphanumeric display of ASCII text
- Bit-mapped graphic capacity of 640 × 80 dots (over 51,000 pixels)
- Standard typewriter keyboard
- 8 user-definable function keys
- MS-DOS* operating system
- GW-BASIC*** programming language
- Standard RS-232C interface

Software

Software for the PC-5000 portable computer is readily available. Its 16-bit MS-DOS* operating system takes advantage of the wide array of MS-DOS* software available in today's market.

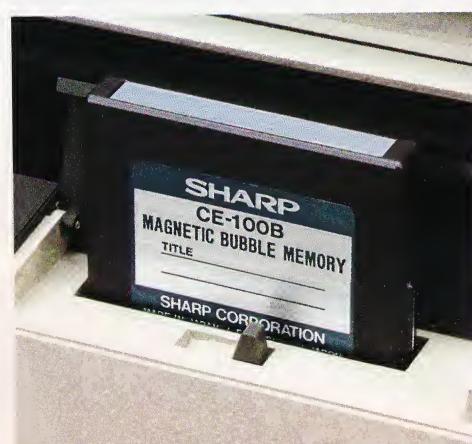
Software available are a **word processing package** that allows you to create, edit, store, and save documents, letters, memos, or any form of written correspondence. A **communications package** allows you to "talk" to other computers, mainframes, data bases, even another PC-5000. Correspondence you create on the word processing package can

be sent via electronic messages to a reception point.

Spread sheet analysis is easily accomplished for forecasting, budget analysis, and answering "what if" questions. **An executive planner** allows you to schedule your time with an appointment book, create free-form text, address book functions, do list preparation, and make personal mini-data-base entries.

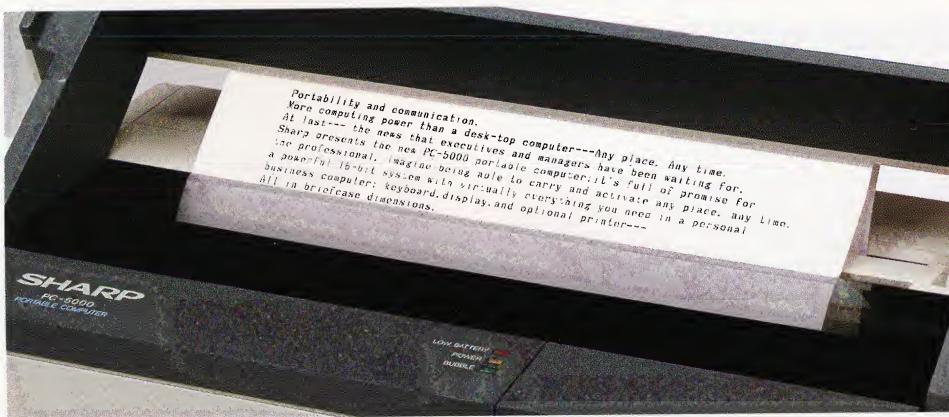
All software functions can be tied together by a unique scratch pad for integration of information between software modules.

Software availability may vary from country to country.



Magnetic Bubble Memory (CE-100B)

To store information, application software, files, or personal data, a 128K-byte removable bubble memory cartridge is available. The PC-5000 has a special drive for the cartridge. It is this unique feature and innovative design that eliminates the need to transport bulky disk drives. It acts just like a typical disk drive and allows file transfer and information interchange between cartridges and floppy drives.



Print Unit (CE-510P)

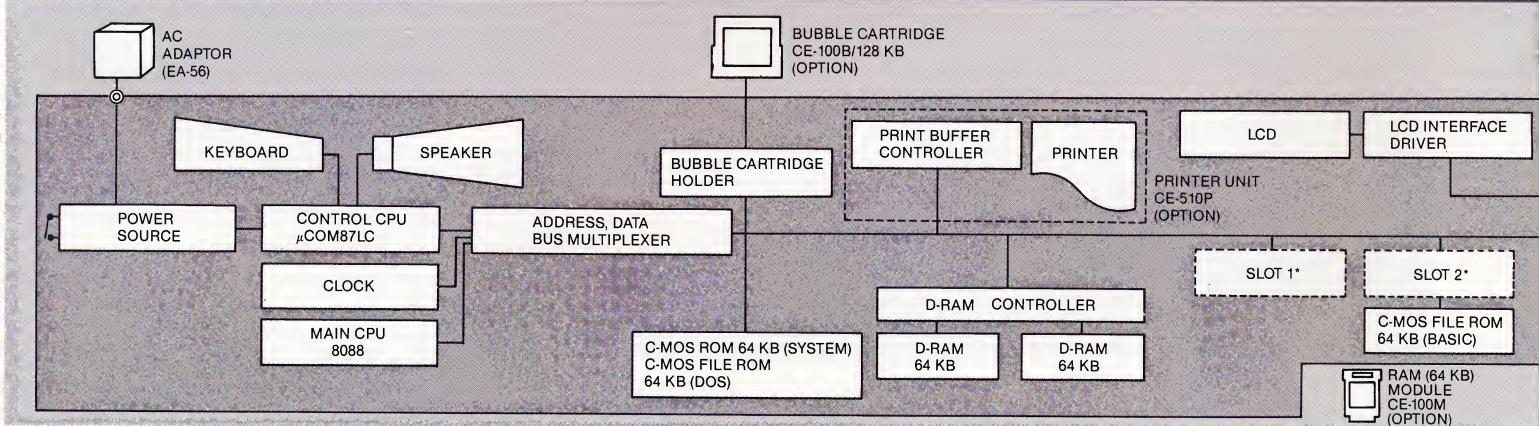
An innovative, battery-operated thermal transfer printer can be integrated into the design of the PC-5000. The thermal transfer system allows whisper-quiet printing on thermal or bond paper. When using plain bond paper, a cartridge ribbon is inserted to ensure correspondence-quality reproduction.

- 37 characters per second (12 characters per inch)
- 80-column print width
- Variable pitch (10, 12)
- Thermal transfer method serial printing
- Uses thermal or plain bond paper

The PC-5000—Your Portable Of



SYSTEM BLOCK DIAGRAM



Office.

Today's fast-paced competitive business climate demands high-quality performance and optimum efficiency. Utilization of the proper equipment is vital. The PC-5000 meets your requirements anywhere—in the office, on the road, in your home.

In the office, the PC-5000 is a compact, desk-top, stand-alone computer capable of performing complicated tasks for today's business management. You can connect it to a host computer or data base for file transfer and data collection via an acoustic coupler. Its word processing capability is ideal for report writing, text editing, or business correspondence. Whether alone or connected to a host computer, the PC-5000 creates a new world for you—your own portable office.

Power and portability are the real advantages of the PC-5000. It goes where you go, carrying along the convenience of your personalized office.

Via an acoustic coupler, you can connect the PC-5000 to a telephone line and automatically gain access to your mainframe central data base or another personal computer to renew programs, transfer files, communicate, and obtain the up-to-date information you need to be successful in a competitive world. Key information access is only a briefcase away with the PC-5000.

The PC-5000 Expands As Your Desire for More Powerful Computing Expands

As you chart the expansion of your business or plan your personal growth, you will demand more from the PC-5000. It expands with your horizons. Varied peripheral accessories are available. Built-in interfaces are the first step to system expansion. The PC-5000 includes an RS-232C interface for communication with other computers and printers, and has a 2-slot expansion bus. It even has an audio cassette controller for those who require it. Built-in expansion slots permit the addition of two 64K RAM expansion modules that give you access to 256K

bytes of user storage.

To store more voluminous information, optional mini-floppy disk drives are available. The interface is standard and the drive controller is built into the drive assembly for simple user connection. Two 5-1/4" floppy drives are available and give 360K bytes of storage each.

Integrated into the design of the PC-5000 is a whisper-quiet correspondence-quality printer. Its unique design permits installation while maintaining the compact, briefcase dimensions you desire.

Mini-Floppy Disk Unit (CE-510F)

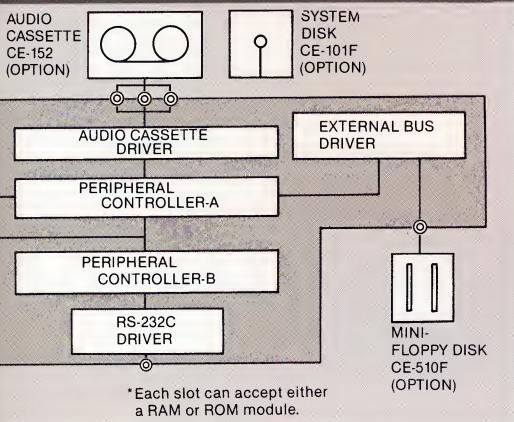
To accommodate massive storage requirements, the PC-5000 easily connects to a floppy disk drive unit. In addition to data, information, and file storage, a program from the floppy disk unit can be loaded into the bubble cartridge. This feature expands and enhances the storage capability of the PC-5000 and allows standard disks and disk-based programs to be run on the PC-5000.

- Two 5-1/4" floppy drives
- 360K bytes of storage on each
- Dual-head system
- IBM**-file compatible



RAM Expansion Module (CE-100M)

The PC-5000's main memory can be expanded to 256K bytes of RAM by the addition of two 64K-byte expansion modules. The expansion ports are conveniently located in the bottom of the unit for simple user installation.



PC-5000

SPECIFICATIONS

CPU		16-bit, 8088 microprocessor
Memory	ROM	192K bytes standard
	RAM	128K bytes standard; expandable to max. 256K bytes (option)****
	Bubble memory	128K bytes (option)
Display	Type	Liquid Crystal Display
	Alpha-numeric	80 characters × 8 lines
	Graphic	640 × 80 dots
Keyboard		Standard typewriter format; 8 definable keys
Printer CE-510P (option)	Type	Thermal transfer method
	Printing capacity	80 characters per line (12 characters per inch) 66 characters per line (10 characters per inch)
	Graphic	1,197 dots per line
	Speed	Approx. 37 characters per second (12 characters per inch) Approx. 30 characters per second (10 characters per inch) 555 dots per second (graphic)
	Paper	Plain bond paper or thermal paper (A4, B5, letter size)
	Ribbon	Cartridge type, black color

I/O Interface		RS-232C; audio cassette (1000 bps.); external bus driver (8 bits handshake)
Peripheral options	Audio cassette	Connectable
	Mini floppy disk	360KB/disk, dual head, double density Media: 5-1/4 inch
	Others	RAM module (64 KB)
Software	Operating system	MS-DOS* (Version 2.0)
	Program language	GW-BASIC***
Extra functions		Clock, sound generator
Power source		Rechargeable lead battery EA-50B (DC 6V)/approx. 6-hour operation; AC adaptor (EA-56)
Operating temperature		5°C—35°C (41°F—95°F)
Dimensions		326(W) × 305(D) × 87.5(H) mm
Weight	Minimum system	
	PC-5000	4.0 kg
	Battery	0.35
	Bubble cartridge	0.07
	Total	4.42
	Printer	1.4 kg
	Floppy with cable	6.16 kg

*MS-DOS is a trademark of Microsoft Corporation.

**IBM is a trademark of International Business Machines Corporation.

***GW-BASIC is a trademark of Microsoft Corporation.

****To obtain 256KB RAM, replace a 64KB BASIC ROM module with a 64KB RAM module. Under the 256KB RAM capability, a mini-floppy disk unit (CE-510F) and a system disket (CE-101F) are required to activate BASIC ROM.

BASIC LANGUAGE SPECIFICATIONS

COMMANDS	FOR PROGRAMMING	OPTION BASE, AUTO, RENUM, DELETE, EDIT, NEW, LIST, LLIST, RUN, CONT, CLEAR, TRON, TROFF
	FOR DISK OPERATION	LOAD, SAVE, FILES, NAME, KILL, MERGE, RESET, SYSTEM, BLOAD, BSAVE
GENERAL STATEMENTS	DEFINITIONS	DEF FN, DEF INT/SNG/DBL/STR, DEF SEG, DEF USR
		REM, END, FOR-NEXT, GOTO, ON-GOTO, GOSUB-RETURN, ON-GOSUB, STOP, IF-THEN-ELSE, WHILE-WEND, LET, SWAP, DIM, RESTORE, LSET, RSET, RANDOMIZE, CALL, ERROR, ON ERROR GOTO, RESUME, MOTOR, CHAIN, COMMON, ERASE, WAIT
I/O STATEMENTS	DISKS	INPUT, LINE INPUT, PRINT, PRINT USING, WRITE, LPRINT, LPRINT USING, OUT, DATA, MID\$=, READ, OPEN, CLOSE, INPUT #, PRINT #, PRINT # USING, WRITE #, LINE INPUT #, FIELD #, GET #, PUT #
FUNCTIONS		ABS, ATN, CDBL, CINT, COS, CSNG, EXP, FIX, INT, LOG, POKE, RND, SGN, SIN, SQR, TAN, CVI, CVS, CVD, INSTR, CSRLIN, EOF, ERL, ERR, FRE, INP, LOC, LOF, LPOS, PEEK, POINT, POS, USR, VARPTR, VARPTRS
STRINGS		CHR\$, LEFT\$, MID\$, RIGHTS\$, SPACE\$, STRING\$, HEX\$, INKEY\$, INPUT\$, MKI\$, MKS\$, MKD\$, OCT\$, SPC, STR\$, TAB, ASC, LEN, VAL, TIME\$, DATE\$
GRAPHICS	IMAGE PROCESSING STATEMENTS	SCREEN, WIDTH, LOCATE, COLOR, CLS, GET, PUT, LINE
	GRAPHIC STATEMENTS	PSET, PRESET, CIRCLE, PAINT, DRAW
SOUND STATEMENTS		BEEP, PLAY, SOUND
FUNCTION KEY CONTROL		KEY, KEY LIST, KEY ON/OFF/STOP, ON KEY GOSUB
COMMUNICATION CABLE CONTROL		COM ON/OFF/STOP, ON COM GOSUB

Design and specifications subject to change without notice.

Distributed by:

SHARP

SHARP CORPORATION OSAKA, JAPAN

CABLE ADDRESS: LABOMET OSAKA
TELEX No. LABOMET A-B J63428



August 15, 1984

PC-5000 SUGGESTED RETAIL PRICE LISTHARDWARE

<u>MODEL</u>	<u>DESCRIPTION</u>	<u>SUGGESTED RETAIL</u>
<u>Computer</u>		
PC-5000S	128K Computer*	\$1,695.00
PC-5000X	128K Computer** with Printer (CE-510P)	1,995.00
<u>Peripherals</u>		
CE-100B	128K Bubble Cartridge	269.00
CE-103M	128K Memory Expansion Cartridge (Thick Cartridge)	295.00
CE-100M	64K Memory Expansion Cartridge (Thin Cartridge)	169.00
CE-152	Cassette Recorder	80.00
CE-510F	Dual Drive (5-1/4")	999.00
CE-510P	Printer	399.00
CE-510T	Modem/Dialer	349.00
CE-513F	3-1/2" Micro Drive	699.00
CE-510E	CRT Monitor Interface	399.00
<u>Accessories</u>		
CE-510BG	Soft Case	19.95
<u>Supplies</u>		
CE-100F	5-1/4" Blank Diskettes (10/Box - Formatted)	99.00
CE-120F	3-1/2" Micro Blank Diskettes (10/Box - Formatted)	129.00
CE-514	Paper Roll Holder	19.95
EA-1LR5	Thermal Paper Roll (63-Sheet Length)	4.95
EA-1LS1	Standard Paper (250 Sheets)	8.50
EA-1LS5	Thermal Paper (100 Sheets)	9.95
EA-50B	Battery (For PC 5000 and 3-1/2" Drive)	36.72
EA-820R	Thermal Ribbon	4.50

SHARP

August 15, 1984
Hardware
PC-5000 Price List

- * PC-5000S includes:
- 1) CPU, Keyboard, Display, 128K RAM, 192K ROM, MS-DOS™ Operating System, GW-BASIC™ Programming Language
 - 2) Bundled software consisting of one 128K Bubble Cartridge and Backup Floppy Disk containing Sorcim Corp.'s SuperWriter (word processing) + SuperTools (Main Menu Controller) + Working Memory Space. Also includes floppy disk containing Sorcim Corp.'s SuperComm (communications software).

** PC-5000X includes all of the above with Printer (CE-510P).

Prices are subject to change without notice. This price list supercedes all prior price lists.

MS-DOS and GW-BASIC are Registered Trademarks
of Microsoft Corporation

August 15, 1984

PC-5000 SUGGESTED RETAIL PRICE LISTSOFTWARE

<u>Part #</u>	<u>Description</u>	<u>Suggested Retail</u>
CE-101F	MS-DOS® With Utilities ²	\$ 59
CE-112F	SuperWriter Deluxe*	129
CE-113B	SuperCalc 2 ¹	369
CE-115F	SuperPlanner ²	129
CE-116M	EasyWriter/Planner/Comm ³	665
CE-117F	EasyWriter II ²	225
CE-118F	EasyPlanner ²	175
CE-119F	EasyComm ²	175
CE-5F01E	WordStar ²	495
CE-5F03E	PFS File/Report ^{2,4}	265

* Deluxe word processing package requires disk drives to execute.

1 Distributed on Bubble Memory cartridge with back-up diskette.

2 Distributed on diskette, may be copied to Bubble Memory cartridge.

3 Distributed in ROM.

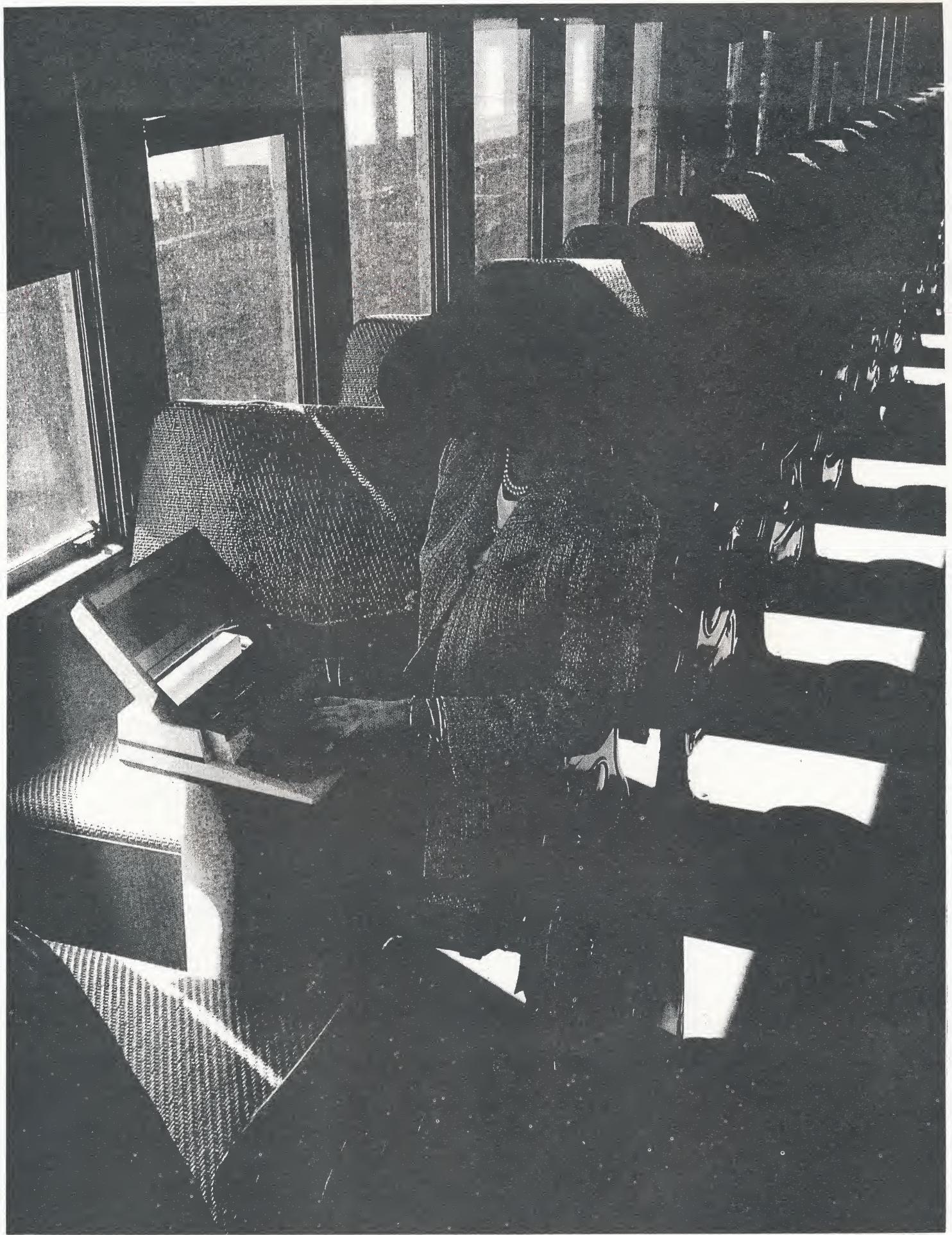
4 Two bubbles required, one for each program.

HARDWARE • ROLAND RACKO

The Sharp PC-5000: A First-Class Traveling Companion

Sharp Electronics' feature-laden
lap-size portable computer
is one of the first of its kind to
offer desktop power and flexibility
at a competitive price.

Photograph: Dennis Kitchen



SHARP PC-5000

The real treasures of computer land have always been out of reach. Most entries into the laptop market have either had toylike capacity or else have been extravagantly priced compared to desktop units of similar power. But Sharp Electronics Corporation has been quietly and effectively building its expertise in lap-sized computer technology. The result is the Sharp PC-5000, a laptop unit that not only rivals current desktop offerings in power and range, but also is priced competitively.

Weighing 13 pounds with optional built-in printer, this diminutive but stylish battery-operated unit contains enough internal memory to perform serious spreadsheet analysis, text processing, or code development. Its built-in bubble memory provides easy access to external data in the quantities that grown-up data appetites demand. Its fold-up LCD screen means that the convenience of visual interaction can follow you wherever you go. Devices such as disk drives, modems, and external printers can be easily attached when you settle down somewhere. Initial software released by Sharp includes a time scheduler, a versatile spreadsheet package, a text processing package, and a modem



The built-in
printer on the PC-5000
takes thermal and plain paper.

communications support program. In addition, many of the programs made for generic MS-DOS machines will run quite comfortably on this machine.

Analyzing even a small machine is a big project. A look at the Sharp's innovative hardware, beginning with the video display, is as good a place as any to start. The video display is a heavily used unit on any computer system. Through it you get the straight scoop to and from your machine. The PC-5000's nontraditional, liquid-crystal display elicits strong reactions, both positive and negative. Of course, the beauty of any display screen is in the eye of the beholder—human preferences in this area are so varied that no single screen can satisfy everyone, and no real agreement on what to look for exists. For me, the three crucial elements are information bandwidth, legibility, and special effects.

The Sharp PC-5000's information bandwidth on a line basis is considerably less than on the typical desktop screen, measuring 8 lines by 80 characters in the normal mode. For many uses, these eight lines are plenty. Text entering, code construction, spreadsheet creation, and command entering all proceed easily, largely because the human mind doesn't often think in terms larger than individual lines when working in this way. Additionally, Sharp's release of Sorcim's *SuperTools*, which provide the basis for some of these activities, have been well adapted for the smaller screen size. Displaying intermediate clumps of creative work is a bit more of a chore, often requiring paging back and forth, which would usually be unnecessary on a larger display. This chore is aggravated by a relatively slow screen update. However, even large displays are not immune from these sorts of problems.

PC-5000

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10 Sharp Plaza
Paramus, NJ 07652
(201) 265-5600

List Price: \$1,995 (includes 128K RAM, monitor, BASIC ROM cartridge, 128K bubble memory cartridge and bundled software including *SuperTools* master menu, *SuperWriter*, and *SuperComm*). Dual 5½-inch floppy drives are \$995, 360K battery-operated 3½-inch minidisk drive, \$695; 128K bubble memory cartridges, \$269; 64K RAM cartridges \$169; 128K RAM cartridges are also available. Printer optional, \$399.

CIRCLE 737 ON READER SERVICE CARD

And since the Sharp has a built-in printer, you can dump intermediate clumps of data to paper for inspection in a bigger frame. You soon develop a synergistic way of using the printer and LCD screen together to overcome the screen's bandwidth limitations.

On a dot basis, the LCD screen's bandwidth is easily as good as that of a typical desktop computer screen. For comparison purposes, if the LCD were expanded into a 25-by-80-line screen with the same dot density, it effectively would have 250 640 pixel characteristics. At its present size of 80 640 pixels, the Sharp PC-5000 can present graphs with excellent resolution (although the graphs are shortened in the vertical dimension when compared with conventional CRT displays).

The Sharp PC-5000's capability to tilt the display at various viewing angles is another plus. However, in order to obtain maximum legibility, the LCD must be carefully lighted. The contrast control helps compensate for varied lighting conditions, but the characters tend to lack punch even in the best of circumstances. Even in poor light, however, the characters are absolutely razor sharp and rock stable. There is no sign of the fringing, screen edge distortion, dot wander, herringbones, waviness, strobing, smear, or flicker that so often plague CRT displays. The characters are well formed and have a consistent visual density. Nonetheless, don't peer at the display for long stretches—get a good light instead.

The screen's special effects include light- and boldface characters in several different widths. I found that the boldface was the most readable. The reverse video and underlining features were completely effective. Cursor-driven programs presented a secure and convenient interface, and the menu effects provided by Sorcim's software made intelligent use of the screen options. The underlying screen manipulation commands allow rapid dot addressing, making animated screens practical. Obviously, the display's lack of a gray scale or color capability makes the

many applications requiring such facilities impractical.

Bubbles

A few years ago, it appeared that bubble technology had burst. For a variety of reasons, several manufacturers had ceased supporting it. But this technology, which stores data by shifting patterns of magnetic regions (called bubbles) in special materials, has been successfully used by Sharp to give the PC-5000 a unique and

The bubble cartridges are cute, neat, robust little blue packages, which you may treat entirely like minidiskettes.

effective approach to portability of large data files. The PC-5000's main unit contains a slot that lets a bubble cartridge function as a pseudo disk drive. Using MS-DOS' virtual drive capability, that slot may serve as either the A: drive or the B: drive, with MS-DOS prompting for the appropriate bubble cartridge as needed. The bubble cartridges themselves are cute, neat, robust little blue packages, which you may treat entirely like minidiskettes. It is a good idea to load up the bubbles before a trip to give yourself the flexibility of extra data memory or convenient storage for application programs.

The bubble cartridges are absolutely silent in operation; a small light lets you know when one is accessed. The system places the names of the MS-DOS programs contained in the main unit's ROM into the directory of the bubble. That way, any bubble inserted in the slot always has in its directory an extra set of items that represent whatever ROMs are currently in

the unit. (Sharp has indicated that additional ROMs may be made available from independent vendors.) The bubble-storage space available to users is then tacked onto the end of those ROM items. It is not quite the 128K advertised, as some hidden MS-DOS system files, placed on the bubbles by factory preformatting, use up about 7K. The preformatting also buries a CONFIG.SYS file in the bubble. This burial makes CONFIG.SYS unchangeable except by sophisticated users who are familiar with MS-DOS system calls. This will probably not inconvenience typical businesspeople using the Sorcim *SuperTools*. My experience with the bubbles was positive; they are clearly the way to go for fully portable operation. I only wish they were cheaper.

The Printer

In the bad old days of the IBM 1403 chain printer, the way you dealt with the printer noise was to make it cute. For example, you could make it print sequences that made tunes out of the print-hammer tapping. Printers have evolved considerably since then, and the Sharp PC-5000 printer is as much of a mechanical and electrical marvel as the 1403 was in its day. But, like the 1403, its performance is also tantalizingly short of perfection. It still makes you want to do cute things with it rather than take it seriously. Print quality, not noise, is the primary issue here. The printer's output is fine for draft copies of text, compiler listings, directory listings, memos and other lightweight stuff, but it's not an ideal choice for formal business letters.

The printer can use plain or thermal paper. In the plain paper mode, the heat of the thermal printhead causes carbon from a ribbon cartridge to be deposited on the paper. Sharp makes the perfect plain paper for its printer, but it is quite pricey. Paper designed to work with Brother thermal typewriters works tolerably well and costs much less.

Sheets of paper are fed one at a time, an operation complicated by the LCD unit,

SHARP PC-5000

which first has to be moved out of the way. In addition, the paper frequently catches on the ribbon cartridge as it comes around under the platen. Luckily, the paper advance itself works well, with complete freedom from skewing. For extended work sessions, though, it's probably best to use roll-fed paper.

The printer has such a high-resolution dot matrix for character formation that it is capable of producing extremely detailed and sharp characters, although individual letters are occasionally muddy or ill-formed. Printing on plain paper with the carbon ribbon produced the darkest characters, but thermal paper had the best character-to-character consistency, and I felt it was superior overall. The print fonts could use some redesign; for example the verticals on the *m* and *w* appeared too narrow in lightface caps and too heavy in lowercase bold.

Programmable options for two separate fonts in both boldface or lightface, along with three different page widths, are packed into the printer controller. A 149-column width allows printing remarkably readable (although necessarily tiny) characters on wide pages. Simple commands also allow the printer to duplicate information from the LCD as it comes up on the screen. The undocumented BASIC commands LCOPY 0, LCOPY 1, and LCOPY 2 allow you to dump the screen to the printer in three different formats. The printer uses a light-sensing mechanism to determine the end of the ribbon. Unfortunately, this mechanism is occasionally fooled into giving a false indication by the careful lighting required by the LCD. This problem, like the paper-catching glitch, can be solved with judicious applications of masking tape in the right locations, but it should never have existed in the first place.

Digit Soup

Communications are critical to the usefulness of a portable computer. As part of its bundle of *SuperTools* software, Sharp provides Sorcim's *SuperComm*. This

package is integrated to work with Sharp's Direct Connect Modem as well as external modems. The Direct Connect Modem is a small, attractive unit that fits neatly into a recessed compartment in the LCD when not in use. The *SuperComm* menus and help screens are well implemented and a beginner doing routine communication with a remote computer should have no unusual troubles. Experienced people who must talk to a large number of computers each using unpredictably different communication protocols, or who have a large amount of data to move around, may feel frustrated by the program.

The Direct Connect Modem cannot auto-dial numbers of greater than 16 digits. If a person is calling computers via a non-AT&T long-distance service, the digit soup required may exceed the capacity of the dialer, making a large part of the automation provided by *SuperComm* and the Direct Connect Modem unavailable. The Direct Connect Modem does not support 1200-baud communication. Users with large volumes of work to do away from home base might want an external modem capable of that speed. Unfortunately, using an external 1200-baud modem presents its own problems. The update speed of the LCD screen is quite slow, requiring the Sharp's CPU to do considerable buffering of received characters. If the host is sending characters at a good clip and you want to stop the characters with a termination sequence, the Sharp has to empty its buffers to the screen before it can send your sequence. So, despite the speed advantage offered by 1200-baud communication, you still wind up being trained in patience.

Although the *SuperComm* manual does warn you, there is no excuse for the printer dropping characters at 1200 baud when you tell *SuperComm* to duplicate screen contents to the printer as they are displayed on the LCD. Also, *SuperComm*'s failure to keep the screen tidy when performing this duplication is inexcusable. The options menu for setting up the communication protocol has the nice feature of

remembering the last setting you used. But the options menu is not organized for frequently changing protocols. It does not remember the position in the list of the last option you changed. It is annoying to be forced to go through a seven-key sequence for every parity combination you try as you experiment to see which one works on the number you just dialed. Finally, while *SuperComm*'s menus provide hand-holding access to many MS-DOS facilities, at times some facilities lie outside the bounds

**There is no excuse
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of these menus. Changing contexts to get at such a facility without losing the remote computer is a 40-second exercise, with copyright banners, function key depressions, and requests for confirmation along the way. This same phenomenon occurs even within *SuperTools*, if, for example, you want to suspend *SuperComm* and go to *SuperCalc*² to prepare a spreadsheet for modem transmission. This design wastes too much precious time.

Receiving data from the remote computer is blessedly transparent; I didn't find any sequences that made the Sharp burp—that's a plus. But there was also no way to turn the transparency off so that the remote computer could send cursor control sequences that would affect the LCD screen. Under *SuperComm*, the Sharp PC-5000 can emulate only a dumb terminal. *SuperComm*'s send/receive protocol for files is primarily a Christensen protocol (known also as XMODEM) that is popular

but not universal. A prospective user of *SuperComm* should verify that the remote computer in question supports this particular protocol.

The Direct Connect Modem can also be used as a numeric keypad for data entry. Because of its built-in microphone and speaker, it also functions as a hands-free telephone. Voice quality in the hands-free mode was exceptionally good in both directions, but a slight background whine emanated from the speaker and also from the phone line.

Under the Hood

A stripdown of the main unit revealed a surprisingly spacious construction; nothing looked cramped or crowded. There were plenty of precision-stamped bracing members and the mating of bracing members was excellent, with accurate tolerances evident on all interconnecting members. For those of you who don't look under the hood, this bracing ensures that your Sharp will get where it's going in one piece. All construction was modular with easily separable subsystems. While *PC Magazine* has no standard drop test, I accidentally had the opportunity to test the robustness of construction. In my case, it occurred at an airport, when the shoulder strap of the carrying bag containing the Sharp main unit and disk drive suddenly broke, causing both units to drop about 2 feet onto concrete. The units suffered no damage.

Inside, four boards were visible: bubble driver, ROM, RAM, and CPU. The boards were of high-quality construction and no engineering patches were apparent. The boards were all well braced at multiple points. Electrical connections between them were made with sockets and ribbon cables. A NEC 8088 was used on the CPU board and NEC 4164 RAM chips were used on the RAM board. Two spare mounting pads were visible on the ROM board, so you might expect that future enhancements to internal ROM software are a possibility. The unit's size reduction was accomplished by avoiding the stan-

PERFORMANCE CHART

	Excellent Points	Good Points	Annoyances	Needs Work
HARDWARE				
Main Unit:	<ul style="list-style-type: none"> ● Keyboard touch ● Compactness ● Colors & visual appearance 	<ul style="list-style-type: none"> ● Weight ● Operating time on battery ● Price ● Construction ● Expandability 	<ul style="list-style-type: none"> ● Slow speed ● No 8087 processor 	
Printer:	<ul style="list-style-type: none"> ● Dot detail ● Size of unit 	<ul style="list-style-type: none"> ● Flexibility of fonts and widths ● No skewing 	<ul style="list-style-type: none"> ● Paper loading ● Speed ● Special paper needed 	<ul style="list-style-type: none"> ● Consistency of character quality
LCD:	<ul style="list-style-type: none"> ● Solidity and sharpness of image ● Tilt feature 	<ul style="list-style-type: none"> ● Character shape ● Resolution ● Flexibility of fonts & widths 	<ul style="list-style-type: none"> ● Contrast ● Size of display 	
Bubble Memory:	<ul style="list-style-type: none"> ● Convenience 	<ul style="list-style-type: none"> ● Physical size of cartridge ● Robustness 	<ul style="list-style-type: none"> ● Can't adjust CONFIG.SYS file ● Space taken by system files ● Limited storage capacity 	<ul style="list-style-type: none"> ● Price
Mini-Floppy:	<ul style="list-style-type: none"> ● Reliability 	<ul style="list-style-type: none"> ● IBM format compatibility 	<ul style="list-style-type: none"> ● Noise 	<ul style="list-style-type: none"> ● Hard disk add-on capability
Modem:	<ul style="list-style-type: none"> ● Size of unit ● Voice quality 	<ul style="list-style-type: none"> ● Appearance ● Numeric keypad 	<ul style="list-style-type: none"> ● Whine ● No built-in 1200 Baud 	<ul style="list-style-type: none"> ● No more than 16-digit ● Auto-dial capability
SOFTWARE				
Documentation:	<ul style="list-style-type: none"> ● Sorcim SuperTools 			<ul style="list-style-type: none"> ● MS-DOS manuals
Communications:	<ul style="list-style-type: none"> ● Easy for novice 		<ul style="list-style-type: none"> ● Tortuous context shift to MS-DOS or other tools 	<ul style="list-style-type: none"> ● Drops characters on printer at 1200 baud
Spreadsheet:	<ul style="list-style-type: none"> ● Tutorial 	<ul style="list-style-type: none"> ● Versatile 	<ul style="list-style-type: none"> ● No macros 	
Text Processing:			<ul style="list-style-type: none"> ● Tortuous context shift 	
Other:		<ul style="list-style-type: none"> ● Alarm system ● Menu layout & function key consistency 	<ul style="list-style-type: none"> ● Not entirely PC-compatible 	

This table summarizes the various features and flaws of the Sharp PC-5000. "Excellent Points" are astounding, mind-boggling qualities that you should drop everything and write your mom about. A favorable mention of the machine's "Good Points" the next time you are at a cocktail party will indicate that you are a member of the Inner Circle. Items in the "Annoyances" category are the ones that you wish would really just quietly go away because they form an unsightly blot on an otherwise well-crafted instrument. Finally, whoever was responsible for approving an omission, bug, or nonfeature labeled "Needs Work" lacks discriminating taste, common sense, and foresight, and all manner and number of the King's men should be assembled to fix this up as soon as possible—or earlier.

SHARP PC-5000

dard DIP ICs in favor of flat-pack and leadless carrier versions. Several custom components and hybrids were also visible. Shielding plates to prevent RF interference were everywhere, and some areas were double shielded. The power supply was in its own separate cage.

The keyboard was solidly constructed and well braced. A dust membrane under the keys keeps flying bits out of the innards. Like the other subassemblies, the LCD screen unit is completely modular. It is packaged internally with rubber damping to absorb shock. Several electrical components housed in the subassembly help drive the LCD display. Shielding plates were also visible in this unit.

The line printer, shock mounted in its own metal basket, contains three motors for control of paper advance and printhead motion. It has its own controller board that attaches to the main CPU board via a ribbon cable and, as a nice touch, a zero-insertion-force connector. Since the printer is a user-installable option, such a connector helps ensure that fumble-fingered users don't put stress on the ribbon cable.

More Gas

Perhaps as a move to conserve power during battery operation, Sharp runs its 8088 processor at a speed below that of typical desktops. The prime number test used in *PC Magazine's* evaluation of other IBM compatibles (see the cover stories in *PC*, Volume 3 Number 6) took the Sharp about 2 minutes and 53 seconds compared to an IBM PC's 1 minute. A compiled C program that wrote a file of 20 records of 1,024 bytes each to disk 10 times took 61 seconds, compared to a PC's 55 seconds. Bubble-write time was about the same as the Sharp disk. The same number of read operations took 1 minute, 43 seconds on the Sharp floppy as compared to 58 seconds for an IBM PC. Bubble-read time was 1 minute and 38 seconds.

The machine is a bit slower than the IBM PC all around. Normally, this wouldn't bother me in lap-sized device;

I'd be grateful to have anything at all. But since the Sharp is such a generally strong performer, I'm tempted to use it as a desktop workhorse. It sets such standards for itself in other areas that the impatient finger twiddling becomes annoying.

Average speed for the printer was about 14 characters per second in the 80-column mode. This is far less than the advertised 37 characters per second. While the print-head appears to move at the advertised speed as it forms characters, the carriage-return cycle drops the effective speed. Nevertheless, 14 cps is tolerable considering the printer's portability and flexibility.

Battery power provided about 6 hours of idle power-on time but only about half an hour of operation under a heavy combined load of the printer, bubble, and modem. The Sharp's main unit was impervious to pulling the plug while being powered from the AC pack—indicating a well controlled switch-over from AC to battery operation. Floppy drives performed flawlessly, and somewhat quieter than the PC's drives. Extra RAM and ROM cartridges slip easily in and out of slots in the bottom of the main unit. These provide a nifty way to keep the software capacity from topping out early.

The PC-5000 has no provision for 8087 support, and a Sharp spokesman indicated that such support is not planned at this time. Regrettably, neither is hard disk support in the works. Soon to be delivered, though, is a battery-powered 3½-inch disk drive and a direct video interface for a full-size external monitor.

PC-Compatible?

In a phrase, the Sharp PC-5000's PC-compatibility could be described as, "close, but no cigar." My tests revealed that the Sharp would generally run any PC-compatible commercial software that did not think an IBM screen was around. So, for example, the Whitesmiths and Lattice C compilers ran perfectly. On the other hand, programs such as *1-2-3*, *WordStar*, and *Flight Simulator*, which depend on the IBM screen characteristics, the

IBM diagnostic programs, or PC-DOS, would either give an error message on the LCD screen or send the machine off into hyperspace—from which recovery was possible only by powering down and up. IBM utilities such as DISKCOPY also caused hyperspace runs or failed to load at all. (The Sharp-supplied version of DISKCOPY, of course, performed satisfactorily.) *dBASE II* was somewhere in between. Most features worked, but browsing was problematic.

Reading and writing IBM-format disk-

The keyboard layout is different from the PC's, which is either a plus or a minus depending on your personal preferences.

ettes was more satisfactory. The higher density nine-sector diskettes could be read or written without a hitch. IBM single-density diskettes could also be read or written, but only if the original start-up boot was from the Sharp MS-DOS resident on diskette. If booting was done from the bubble version of MS-DOS, not even the directory of a single-density diskette was readable. This difference between bubble and diskette boot-program capabilities could be confusing. Copying files from bubble to diskette works only with the COPY command. DISKCOPY complained when asked to try.

The keyboard layout is different from the PC's, which is either a plus or a minus depending on your personal preferences. Key placement is more conventional for standard letter and special character keys. Some of the keys are bigger and thus easier to use for hunt-and-peck typists. Some keys found on the PC's keyboard are not

present on the Sharp and the Sharp implements some special features that have no equivalent on the PC. Especially interesting are the On/Off keys. These keys can be used to put the Sharp to sleep—either for a pre-set interval or until the On key is pressed. Upon waking, the Sharp will then do various programmable things such as start up communications or play tunes at you in a three-octave scale. The Sorcim *SuperTools* also provide access to this feature for calendar reminders. The PC's PrtSc key is missing, although the Esc-7 key combination is an undocumented escape sequence that causes the printer to display a remarkably miniaturized version of the current screen contents.

UNIX Too

Encouraged by the Sharp's response to the standard tests, I devised an even more revealing compatibility test. Whitesmiths, Ltd., makes a multiprocessing multi-user UNIX lookalike called Idris. The IBM PC version of Idris runs as a "program" under MS-DOS, allowing concurrent access to both MS-DOS and the Idris multiprocessing facilities. Whitesmiths does not officially support a non-hard-disk version of Idris. The company's position is that a typical user will want to have on-line all 1.7 megabytes of utilities, compilers, text-processing stuff, and other wondrous goodies. It is a well-kept secret, however, that Idris will actually run on anything except a pop-up toaster.

How does Idris do on the Sharp? By diligently extracting salient intelligence from Whitesmiths' detailed installation guide for hard disk applications, I configured a creditable system running on the Sharp with only mini-floppy drives; there were, however, fewer goodies directly online. Even more interesting, after a little surgery on the bubble memories, I managed to further move Idris and a handful of utilities to the bubbles alone. Armed with a belt clip full of bubbles, the Sharp main unit, and an airline ticket, I took to the sky. I couldn't resist trying "cordless" Idris while on the plane. In went the MS-

DOS bubble to boot MS-DOS; in went the Idris bubble to get up Idris and its word processing software. In went the commands to set up a RAMdisk simulated under Idris. And there I had it, UNIX-type facilities on batteries and bubbles 20,000 feet in the air. I had fulfilled Tom Plum's prophecy of lap-size wonders from the UNIX world ("A Classy Idris in the UNIX Neighborhood," *PC*, Volume 3 Number 10).

A Dying Boast

In Stanley Kubrick's classic movie *2001: A Space Odyssey*, there is a poignant scene where the last remaining human aboard the Jupiter probe vessel *Discovery* is forced to dismantle HAL, the great on-board computer. Sneaking past HAL's safety circuits, the lone human slowly pulls out HAL's memory crystals one by one. As "his" mind is being removed piece by piece, HAL pleads for himself. As more and more crystals are removed, HAL's speech becomes less and less organized until, finally, the once-proud HAL is reduced to being capable only of singing a child's nursery rhyme.

The designers of the Sharp PC-5000 have included no such swan song. If you pull out all the bubbles, disconnect all the disks, remove all the RAM extensions, and defeat the ROM cartridge, somewhere deep in the heart of the Sharp PC-5000, a special circuit is activated. The Sharp goes into COMDEX mode. It begins to display a feature list replete with function-key-driven menus, graphic whizbangs, and sales-oriented narrative. HAL went down garbling a nursery rhyme. The Sharp PC-5000 goes down boasting, as well it should, for it is a nontrivial, feature-laden unit at a competitive price. ■

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PC-5000 PORTABLE COMPUTER

- 16-Bit/8088 CPU
- MS-DOS Operating System
- GW-BASIC (in ROM)
- 128K RAM, Expandable to 320K
- 192K ROM
- 8-Line x 80-Character LCD Display
- Weighs under 10 lbs.



SHARP

There's More . . .

A host of new products have been added to the PC-5000 family. All of them add to the already powerful capabilities of the *most* portable of portables.

- **3½" Compact Single Floppy Disk Drive**

- 360KB Storage
- Compact (5½" W x 2.5" H x 8.5" D)
- Portable Operation with optional battery
- Weighs 7 lbs.

- **128KB Memory Expansion Cartridge**

- Expands internal RAM to 320KB when used with 64K Memory Expansion
- Thick Cartridge
- Conveniently plugs into slot on bottom of PC-5000

- **CRT Adaptor**

- Allows 25 line display monitor to be attached to PC-5000
- Enhances display for non-portable operation

- **25 Line Operating System**

- Software Screen Buffer
- Requires RAM Expansion
- Runs Generic MS-DOS Software
- Required when using CRT Adaptor
- Provides 8-line windows with user interface instructions for moving screen within the 25 line buffer

- **VT100 Terminal Emulation**

- PC-5000 to DEC Communications
- Asynchronous Communications
- Selectable BAUD rates
- Emulates VT100 escape sequences & special graphics
- ASCII file transfer
- Modem 7 binary file transfer

- **Easy Pack (includes EasyWriter II, EasyPlanner, EasyComm)**

- Distributed individually on diskette or all three on ROM
- Provides Word Processing, Spread Sheet and Communications Software
- ROM version allows entire 128K on bubble to be used as data storage.

- **Wordstar**

- Most popular WP package from MicroSoft
- Distributed on diskette

- **PFS File/Report**

- Provides data base Management system and report generator
- From Software Publishing Corp.
- Distributed on diskette

- **Soft Carrying Case**

- Holds PC-5000, AC Adaptor, Bubble Cases, Paper and Notes
- Shoulder Strap

- **Roll Paper Holder/Thermal Paper Roll**

- Attaches to back of PC-5000
- Paper Roll provides continuous form and unattended printing

Additional information is available from your Sharp PC-5000 dealer.